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ABSTRACT

Ways that business and colleges can work together to promote continuing higher education and collaboration models are described in articles based on a forum sponsored by the National University Continuing Education Association's Continuing Higher Education Leadership Project. The perspectives of industry and higher education are covered, along with the topics of lifelong learning and early retirement. Article titles and authors are as follows: "High Tech Industries: Staying on the Technological Forefront through Reducation: Implications for Academica" (Terry L. Gildea, Hewlett Packard); "The Corporation and the Campus: Developing New Partnerships" (Robert DeSio); "Quality and Accountability: The Foundations of Collaboration" (Jack Bowsher); "New Roles for Continuing Higher Education" (Mary Walshok); "Toward a New Approach to Collaboration" (Philip Nowlen); "Demographic Challenges for Collaboration" (Allan Ostar); "Effective Education, Technology, and Teaching" (Theodore Bickart); "Knowledge Maintenance for the Professional" (Michael Danchak); "The Limits of Technology" (Leon Botstein); "Early Retirement: Implications for Higher Education" (Dale Hiestand); "The Economic Costs of Early Retirement" (George Anderson); "Retirees as Students" (Letitia Chamberlain); and "Second Careers" (Art Pumo). The following programs are described: Pennsylvania Technical Assistance Program, Colorado State University/Hewlett Packard Software Retraining Program, National Technological University, University of California-San Diego Executive Program for Scientists and Engineers, and University of Illinois-Motorola Masters Program. (SW)

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A Note of Appreciation

This University Forum would not have been possible without the efforts of David Grossman, director of independent study at the University of Minnesota, who designed and organized the program.

Carol Gasparach, CHEL Project associate, worked tirelessly to assure the smooth functioning of the Forum and production of this publication. Jean Preer, journalist and educator, served as the reporter for the Forum. It is her work that formed the basis for this document. Wendy Sibelman and George Faux of the NUCEA staff played a major role in the preparation of this publication. Kate Lowman provided final editing assistance.

Many of the members of the CHEL Commission actively participated. Paul Miller, president emeritus of the Rochester Institute of Technology, Governor John Carlin of Kansas, and Harold Miller, dean of continuing education and extension at the University of Minnesota, chaired the three main sessions.

Finally, the Project is most grateful for the invitation of IBM's Corporate Technical Institutes from Robert DeSio, IBM's director of university relations, and the support of the IBM Corporation. The Forum was the first "outside" event held at CTI, and the efforts of Robert DeSio and his staff contributed to the success of the program.

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Challenges to Continui
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The NUCEA Continuing Higher Education Leadership Project

Social, economic, and technological change presents continuing higher education with the need for forceful and effective leadership. Recognizing that need, the National University Continuing Education Association (NUCEA) in 1984 initiated a five-year project to develop leadership both within and for continuing education, and to identify significant policy issues affecting the field. The NUCEA Continuing Higher Education Leadership Project (CHEL) is funded by the W.K. Kellogg Foundation, and is directed by a national Commission including representatives from government, industry, and higher education.

The University Forum

Continuing higher education has historically been in the forefront of higher education's efforts to respond to the needs of society. The University Forum represents one of the CHEL Project's efforts to identify and explore the significant issues facing society. Through the Fora, leaders from continuing higher education, business, public affairs, and higher education come together to discuss and debate these issues. What emerges is not only a greater understanding of the issues, but also ideas for programs responding to the issues and needs identified at the Fora.

The CHEL Commission's goal is not only to explore the critical issues which it identifies, but also to develop a model of issue leadership development.

The Thornwood Forum: Corporate/Campus Coll

Too often, colleges and corporations as the "vendors" for a slice of the billions of d tion and training. In turn, m articulate their long-term ne cation and are then disapp cannot respond with new pr

The goal of this Universi yond the vendor-client rela basis for mutual understand challenges facing both indu tion, by better understandin porate culture and of the begin to see where our co

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nicate effectively. There has been considerable discussion of late and much written, but what remains is a serious need for mutual understanding.

The site of the forum, IBM's newly constructed Corporate Technical Institutes, provided an appropriate setting to explore corporate/campus collaboration through high technology industries. The increasingly rapid pace of technological change and increasing international competition, for example, demand improved education, training, reeducation, and retraining efforts. High tech corporations are making increasing use of their technology in their own education and training, suggesting potential uses in the college classroom, a point of not inconsiderable controversy on university campuses. Also, the "brain drain" of top scientists and engineers to the corporations has serious implications for higher education. Finally, the increasing use by the computer world of early retirement to maintain full-employment policies suggests the growth of a new group with special needs for higher education.

Terry Gildea, manager of technical training at Hewlett Packard, told the Forum that "the future of your institutions and mine depend upon our being able to come up with creative and workable cooperative efforts."

James B. Hirsh, Director
NUCEA Continuing Higher Education
Leadership Project

High Tech Industries: Sta
Forefront Through E
Implications

Terry
Manager of
Hewlett Pac

In the next decade, our system of higher education, one of the most vibrant and envied in the world, faces great changes. Those of us in industry have already experienced a similar set of changes; perhaps our experience will offer some perspective on these challenges for academia.

Industry Problems

American industry is faced with great competitive challenges. The Japanese have revolutionized the American automobile industry. They taught market researchers that there really was a huge market for small, fuel efficient, inexpensive cars. They detected, before we did, the shift in our values which ended the reign of the automobile as a major determinant of status in American society.

Although one can make too much of it, the Japanese have also taught us that there is more than one way to organize a manufacturing company. Their concepts of labor relations, "just-in-time" inventory, and total quality control have been widely studied and, in some cases, adopted by American companies.

Closer to home, at least for me, is the success of the electronics industry. Television sets are no longer built in this country. Even technically advanced and expensive consumer electronics are built in Asia. These are not just assembly operations. The Japanese invested, created the market for, and

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"Even as we wonder why the Japanese are so successful, we continue to educate more lawyers than engineers."

The problem is not just one of technology or engineering. Our traditional commercial trading patterns are undergoing great change. The Pacific Rim nations have become our largest trading partners, but we continue to teach French and German in our schools and only rarely Korean or Japanese.

In our own nation, we are seeing a dramatic change in the ethnic composition of our society. In the San Francisco Bay area, most public notices are printed in English, Spanish, and Vietnamese.

Some studies have indicated that by the year 2000, just 14 years from now, there will be more native Spanish speakers than English speakers in the state of California. In spite of this, we continue to educate our high school students as if they will need no language other than English.

Let me suggest, as one hypothesis, that we are educating people for the wrong jobs and providing them with the wrong skills. Our colleges and universities need to change the educational programs they currently offer. Our nation's future leaders must be prepared to lead in this new global environment. They must be market sensitive in a multinational, multicultural, and multilingual context. The products and services that we offer must compete in an international marketplace.

Language skills are becoming increasingly important. Hewlett Packard has just announced a personal computer with keyboard, display, and printer suitable for Asian languages: Korean, Chinese, and Japanese. For several years, we have manufactured printers capable of printing in Cyrillic or Arabic scripts. Our former exclusive focus on Western Europe is no longer appropriate.

It has often been argued that either we are in or we are about to enter, the information society, that the United States is becoming a service economy, that manufacturing is dying in this country. Like so many generalizations, there is some truth in these observations, but they should not be ac-

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Terry Gildea

University Problems

We in industry are not the only ones facing these problems. Let me assure you that we are well aware of the situation on campus. The same rapid

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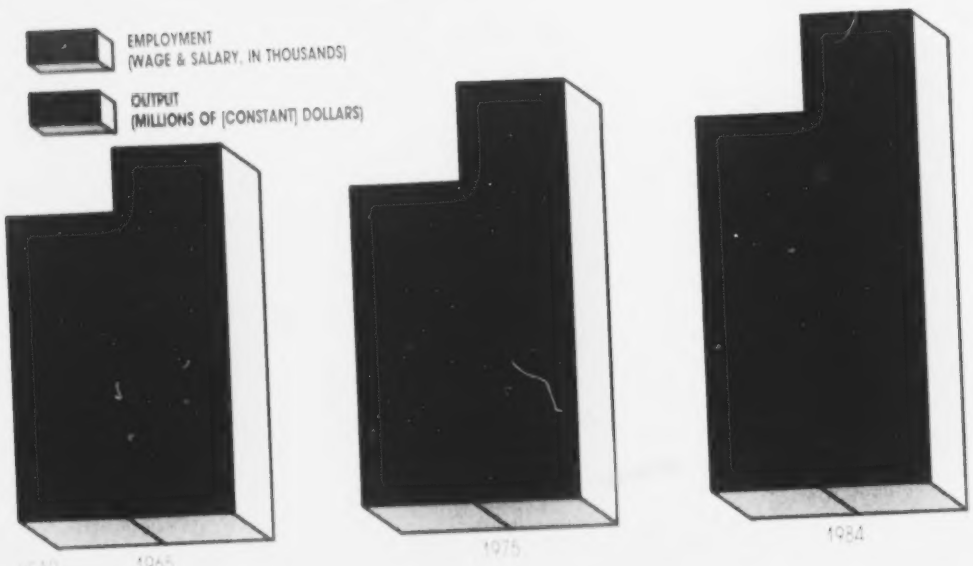

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pace of technology that provides new and dynamic markets for us makes laboratory equipment obsolete for universities. Most of the undergraduate laboratories in engineering colleges around the country are a disgrace. All of the estimates which I have seen place the cost of upgrading these labs at several billion dollars.

Demographic projections indicate that there will be fewer students of traditional college age than we have enjoyed in recent decades. Fewer students translates into smaller classes and lower tuition revenues. The competition for the best students is growing tougher each year.

The concern over federal budget deficits has made it harder to obtain research grants. Stipends for graduate students are few and far between and faculty must be content with less ambitious research projects due to the lack of financial support.

Higher education is faced with a situation of steady or declining revenues. At the same time, the tenured faculty would like to receive annual salary raises. To put it mildly, this is not a situation designed to promote happiness on campus. And the situation carries the seeds of even more serious problems in the future. Earning a Ph.D. and undertaking a lifetime of teaching and research on campus is not viewed by our brightest students as an attractive career choice.

The senior faculty are left with crushing workloads. They must write more research grants be-

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Industry's Solution

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of this University Forum, IBM's Corporate Technical Institutes, represents IBM's commitment to continually educate its technical workforce.

The Campus Solution

The "villain" in all this is technology, more particularly, the rapid pace of technological change. And yet the same technology that leads to the problem also provides us with the solution. Let me give you an industrial view of this opportunity, and then be so bold as to suggest some ideas for the campus.

I think that we should consider all of the "bad" things which I have been discussing as real opportunities for improving our respective organizations. The problem is that we all want opportunities, but none of us wants change. Change, however, is the technological imperative of our age. Since we do not have a choice, my position is that we should make the best of this situation.

At its most fundamental level, the solution boils down to getting more output from the same resources; what those of us in industry call productivity improvements. The way to free faculty time for self improvement is to find ways to teach more per hour. The way to find more money for faculty salaries is to make each faculty member more productive. This is not an argument that is easily sold to faculties. Before the advent of the intellectual workforce in industry, it would probably have been impossible to argue for increased productivity, and even now it will be difficult.

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PHOTO: University of Maryland University College

ology in higher education is evident in this microcomputer lab at the University College.

d ways to make research constantly developing tools lett Packard engineer more h allow the average engi- intellectual work in the stan- eek.

oping teaching techniques learn faster and more thor- hich allow the average stu- a 40-hour week. In fact, we working with two MIT profes- sors to revise their teaching materials for a major undergraduate course to help them make the pedagogy more effective.

The idea that we need to use appropriate technologies to improve teaching productivity is not limited to the engineering sciences. We need to use the same technologies in teaching the humanities. One of the problems with our current engineering curriculum is that there is not enough time to include sufficient study in the humanities. Engineering students spend all their time studying

engineering and when they graduate, they don't know how to apply that knowledge to solving society's problems.

If we could improve the productivity of the learning process, we could make time for engineering students to take more liberal arts courses. They could learn to be better communicators and to work more effectively with people in organizations.

We have, of course, made some progress in applying the new information technologies to academic life. Many college libraries now have computerized databases for catalogs. Many students can use computer terminals to search the literature in their fields. Some students are bringing their own personal computers to the campus to use mainly as word processors, and some institutions now require that each student purchase a personal computer. But we have yet to reach the point where these simple tools are applied on a scale anywhere approaching their applications in industry.

It would seem to me that television could be much more widely used on campuses, and not just to record "talking head" lectures. As anyone who has watched public television knows, the television camera can bring us new experiences not economically obtainable in any other way. It can allow students to see natural science in the most remote places on earth, far under the sea and in dangerous environments. Television has even transported us inside the human body.

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If television and computers are individually important to improving teaching, how much more important is their marriage, the computer controlled video laser disc? Here we have a technology which promises to offer us the best of both worlds. Using techniques such as those used in the famous MIT tour of Aspen, Colorado, we can provide the student with real individualized exploratory learning experiences.

Now, just having these tools and realizing their potential does not give us good education. We all know that most television is terrible, or at least not very educational. Using these tools requires enormous commitments of resources, both time and money. At Hewlett Packard, we operate a network quality television studio. It costs us $2,000 per minute to produce educational material. However, for many subjects it is still the cheapest alternative.

In general, I think universities have a much too constrained view of academic specialties. At Hewlett Packard, we have an employee who is a former professor of Greek. His interest in comparative languages, along with his communication skills and desire to teach others, has made him a valuable customer support engineer for computer languages. Unfortunately, he probably would not be hired by any university computer science department because he does not have the proper academic qualifications.

Let us consider another example. For a number of years, Hewlett-Packard has been using satellite television for instructional purposes. We now have what we believe is the largest industrially owned television network in the world. It's wonderful: it brings our top people to our employees, regardless of where they are located. The National Technological University,* offers similar advantages to universities. It is now possible for engineering schools to offer their students special courses which attract low enrollments without having to hire a faculty member in that narrow specialty. It is a logical extension of the cross registration arrangements which are common in higher education.

As many educators will attest, these efforts at cooperation do not come easily. There are many political barriers to overcome. The human species is naturally a territorial animal, and the turf wars resulting from these efforts are legend. My message is that the coming of the new information age leaves us no choice but to solve these problems. The future of your institutions and mine depend upon our being able to come up with creative and workable cooperative efforts.

The best teaching is, or ought to be, a highly personal activity. As teachers, we should be humble enough to recognize that most learning takes place in the dormitory, not in the lecture hall. I am

*See description of NTU, page 25.

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prided ourselves on the breadth of our catalog of-
ferings and the independence of each division,
each an expert in its own field of activity.

The internal culture of our organization re-
warded independence. At the margins, our divi-
sions competed against each other. We felt that
some internal competition was healthy. This system
built one of the great industrial organizations of the
modern world. It has been studied, written about,
and imitated. It has been fantastically successful.
A few years ago, we found that the very reward
system that had been responsible for our past suc-
cess stood in the way of our future progress. Today,
the critical need is to build systems in which all the
pieces fit together. Anyone who has tried to run
Apple MacIntosh software on an IBM computer, or
to hook up a Hewlett Packard plotter to a Compaq
computer will understand the problem. Now, the
requirement for success is cooperation, not com-
petition.

I will not insult your intelligence by drawing the
analogy between our catalog and yours, between
our divisions and your departments, between our
need to change and yours. I have heard at least
as many arguments as any of you about quality
control of the final product and how it would be
damaged by letting some other person or depart-
ment have some influence over it.

A More Perfect Partnership

We must form more perfect partnerships between industry and academia if we are to accommodate the rate of change which we are experiencing. Specifically, universities and colleges will have to rethink their missions. I will even suggest what that new mission should be. Higher education will have to become the principal provider of lifelong learning, both to its own faculty and staff and to graduates working in industry.

University faculty need lifelong learning for a number of reasons. First, as intellectual stimulation to enrich their own professional careers. We need to develop cooperative programs in which industry provides short term employment opportunities for college faculty. This is what I like to call the "reality check." It is an ideal way for faculty to learn about what their students will face in the workplace after graduation. There are many skills required on the job which are not commonly taught in college. Yet most college students rely on the teaching faculty to guide them in assessing their career strengths and weaknesses.

Much of the development of new technology now takes place in industrial labs. This is a relatively new phenomenon. Historically, universities discovered new knowledge and industries developed the commercial applications of these discoveries.

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The challenge which I suggest then, is three-fold. First, think about changing the subjects taught and about using knowledgeable experts from industry to keep abreast of the latest developments. Second, think in even broader terms as you seek to expand your audience beyond the traditional 18- to 22-year-old undergraduate, including industrial employees and your own faculty. Finally, change your organization and reward system to promote effective use of the best educational technology to achieve these goals.

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INDUSTRY'S PERSPECTIVE

Technological change is affecting all sectors of society, but it often hits industry sooner and more intensely. As a result, the traditional relationship between corporations and higher education is changing as well. At the university, four representatives from high tech industries discussed the challenges facing both sectors and suggested approaches for more fruitful partnerships.

The Corporation and the Campus: Developing New Partnerships

Robert DeSio
Director of University Relations, IBM

Rapid changes in the knowledge base challenge the ability of industrial scientists and engineers to stay current and the capability of universities to offer up-to-date courses and degree programs. Factors in the marketplace, such as international competition and the rapid pace of technological change, have required corporations to act faster, adapt more quickly, and forge ahead of their scientific and technical counterparts on campus. In manufacturing, high tech engineers are actually applying new technologies to products before the underlying scientific principles are understood.

Corporate/campus collaboration is crucial. Higher education provides the fundamental knowledge base while industry provides training that enables technical people to do the jobs we provide them. When people first graduate from college, their education is whatever training they've had. Training and education [illegible]

[illegible] In the face of these pressures, corporations have moved to education in order to help people to get the skills they need. [illegible] a fundamental knowledge base, new disciplines, high tech industries, [illegible] the creation of the Valley of [illegible] and the [illegible] and [illegible] [illegible] 1960, IBM established [illegible] and invited [illegible] programs so that the faculty would be able to set up courses [illegible] Three or four years ago, [illegible] engineering [illegible] the need to develop [illegible] and set up a program [illegible] courses in robotics, CAD [illegible] meeting at a time when

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country offered a masters degree in manufacturing systems engineering. After establishing the Manufacturing Technology Institute, IBM ran a competition to stimulate universities to develop graduate programs in manufacturing engineering, and gave grants of $2 million each to five institutions to support the establishment of graduate programs. There are now 56 such programs in existence. We set up our schools out of desperation and then we tried to influence the academic community.

Barriers to Collaboration

In general, universities are not organized to respond quickly to the needs of high tech industry. The product cycle, for example, is contracting. Once four or five years from invention to design to production, the cycle today is far shorter. This phenomenon requires industry to move rapidly. The discovery of new technologies often does not follow traditional academic disciplines.

The world is becoming interdisciplinary and that's a problem in universities. You have rigid departments, and in an interdisciplinary world, there is difficulty in cutting across those departments and disciplines. That is why, from time to time, in trying to be responsive to what may be the shortsighted needs of industry, it is hard for you to put together programs.

Corporate/Campus Collaboration

Mary Walshok

Allan Ostar

Philip Nowlen

Robert DeSio

Jack Bowsher

At the same time, corporations have not articulated their strategic needs to the academic sector. Instead, they have turned to universities for quick assistance, not understanding that it often takes universities three to five years to organize the curricula necessary for new graduate programs. Industry has to be much more crisp in identifying where it is going and letting educators know about it. That is why partnerships are important.

Partnerships

Business and industry already recognize that learning is an integral part of the job. In this country, we are evolving rapidly to a national strategy which includes continuing lifelong learning. Industry must rely on universities for help in keeping their employees current. For their part, universities must be more cognizant of how industry is applying basic scientific knowledge, and of what is going on in industrial laboratories. In order to prepare your students properly, you have to have a very tight set of interactions with the industrial and business segments.

New educational technologies have already made possible a variety of corporate/campus collaborations. Instructional television, microwave transmission, and satellite hook-ups mean that employees can take courses at their workplace. Employers are no longer limited to the offerings of the local educational institu
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*See description of MIT, page 26.

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and subject areas, but also in the process of learning and education. How do you use all that technology to reinforce and help the process of learning?

Sharing personnel may offer other avenues for collaboration. Industry, by offering attractive salaries and research opportunities, has drawn promising graduates away from academic careers. We in industry have an obligation and responsibility to the academic community to give some of that back. IBM and Texas Instruments, among others, have programs to encourage technical personnel to pursue second careers in college teaching, administration, and research, but sometimes such initiatives are thwarted by academic tenure and rigid personnel policies.

New technical employees now expect, as a condition of employment, that their company will support them while they complete their advanced degrees on a part-time basis. This is one reason corporations place so much emphasis on continuing education. We need it, but it is also a competitive matter.

Finally, high-tech corporations would benefit from more collaborative course development. Already in the semiconductor industry, corporations are cooperating in research areas. Industry-wide involvement in curricular concerns could similarly eliminate costly duplication of effort and also facilitate corporate-campus communication.

A bird's eye view of IBM's state-of-the-art Corporate Technical Instit

The IBM Corporate Technical Institutes

The first of the IBM Corporate Technical Institutes (CTI) was established in 1960 to provide IBM professionals with the graduate-level education that was unavailable in universities. CTI seeks to broaden employee capabilities and to explore new developments in systems engineering, computing, and information systems sciences.

The Thornwood facility in New York includes state-of-the-art computing, classrooms, a library, educational delivery systems and support facilities, an information systems ce 250 students, faculty and rium, a dining room, resi creational facilities. CTI a atories used to augment application.

Candidates for CTI er missions process, and are of achievement and exp recommendation of their Students are encourage credit at schools that the

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CTI also broadcasts live courses to other IBM locations via a satellite-based education delivery system. A tutored video instruction program, using videotaped CTI courses, helps meet the increasing demand for courses at distant IBM centers while keeping down the costs of maintaining CTI. Currently, CTI is developing programs for interactive videodisc-based learning systems, computer-based education, and computer conferencing.

Courses are taught by IBM professionals assigned full-time to CTI. Faculty have teaching loads similar to those of many faculty on college and university campuses, and are expected to conduct research in their fields.

In addition, CTI has established three formal university faculty residency programs. The University Faculty Guest Sabbatical Program allows faculty to pursue research related to key curriculum areas and to participate in the Institutes' educational programs as faculty members. The Visiting Professors Program allows faculty from universities with curricula similar to the Institutes' to examine, compare, and exchange ideas about educational activities. The University Faculty Guest Student Program is designed to assist universities in curriculum development by allowing campus faculty to participate as students in the Institutes' educational programs on a full-time basis.

Quality and Accountability: The Foundations of Collaboration

Jack Bowsher
Director of Education, IBM

At IBM, formulating goals and establishing long-range plans to meet those goals is used both to develop new products and to train employees.

A corporation's ability to move into new areas depends on the capability of its people. The recent inclusion of corporate education in IBM's annual planning and commitment process indicates the importance of training and education to the achievement of corporate goals. Education and training are the "delivery system of executives essential to corporate growth, employee productivity, resource management, and the attainment of quality objectives. Changes, whether they involve a new product or procedure, must be preceded by training if they are to be effectively implemented. In corporations such as IBM, which historically has been committed to full employment and promotion from within, employees must be trained to continue in their current jobs. They also need education to prepare them to grow into more responsible jobs.

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as 50 percent of the teaching of factual material to computer-based training and self-study. The classroom should be where you apply the knowledge. That is where you get into the case studies, into the performance-based type programs.

Furthermore, IBM is evaluating its education and training more closely. Most educators in corporations try to resist measurement. In fact, most training directors cannot tell you how much it costs. They don't want to know. They are afraid that if they know, somebody will cut the budget. In our business, the area that has the finest training and education has the most measurements and, frankly, gets the most resources.

Finally, when IBM goes outside the corporation, it is looking for very high quality, customized, cost efficient courses. In discussing a partnership between industrial education and universities, you will find that the companies with money to spend and the desire for partnership are going to expect high quality. They are not going to be a bunch of sloppy amateurs, as some articles have suggested. The key is that we have to be very precise in stating what we need from you so that you can respond to us. Most organizations today are not that precise.

HIGHER EDUCATION'S PERSPECTIVE

Commission members Mary Walshok, Philip Nowlen, and Allan Ostar responded to the issues raised by the speakers from IBM. While focusing on different aspects of possible corporate/campus collaborations, they urged that each sector identify its own role and interests, as well as those areas of shared concerns in order to make dialogue more productive.

New Roles for Continuing Higher Education

Mary Walshok
Associate Vice Chancellor for Extended Studies
and Public Service
University of California-San Diego

Higher education could learn some valuable lessons from industry, particularly in management planning, evaluation, and accountability. IBM's Education Division might provide a model for continuing education programs illustrating how to relate their own goals and objectives to the strategic objectives of their academic institutions.

It may be time for those in the field of continuing education to think of themselves in different professional terms. We have been very good advocates of the adult learner, the individual student. We might want to see ourselves in a slightly differ-

ent role and that is as the in
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Toward a New Approac

Philip No
Executive Director, Office of
University of

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Continuing Education
Chicago

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tion must be defined.

We need to get underneath it in order to discover the self-interests on the part of corporations and universities that are served by real collaboration, rather than by a vendor-contract relationship. We need somehow to identify the self-interests on both sides to enrich the mix sufficiently so as to free both sides from their mutual rigidities.

Corporations and campuses represent different cultures. Extended and in-depth contact, including internships, is needed to foster better communication. Both sides should seek to identify "corridors of ambivalence" through which to establish new relationships. The most promising and most politically neutral area for those of us on the university side is through the service of the social sciences to business and industry. Why not tap into the disciplines of anthropology, sociology, and international studies to aid the work of corporate advertisers, marketing representatives, and planners?

In exchange, universities can learn much from industry. Corporations could greatly assist us, if they knew us better, in terms of our own extraordinarily medieval strategic planning and management problems, and decision support systems in universities and higher education in general. This brand new level of strategic collaboration could make this country much more competitive.

Demographic Challenges for Collaboration

Allan Ostar
President
American Association of State Colleges
and Universities

The interests of education and industry are converging. With the federal budget shifting from science education to basic research, where are we going to find the future supply of scientists, engineers, and mathematicians that we are going to need in companies such as IBM and indeed throughout our society? And, secondly, what can we do in our schools and colleges to give people who are not preparing to be scientists a greater appreciation of the role of science and technology in our society, so that they, in turn, can make intelligent public policy decisions?

The shortage of qualified teachers of science and mathematics in elementary and secondary schools is already critical. Mid-career high tech workers and retirees could be trained to teach not only in colleges and universities, but also in grades K-12.

The pool of high school graduates is shrinking, and minority youths, who are a growing proportion of new workforce entrants, have been traditionally under-represented in scientific and technical fields. Many of these youth will be attracted by the

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of increased competi
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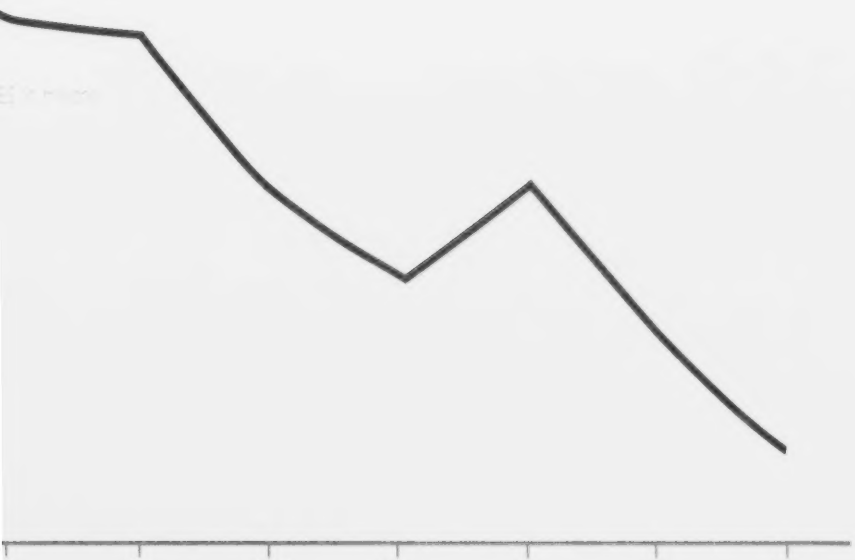
NOTE:
SOURCE:

military service. In the face
tion for high school gradu-
ducation, industry, and the
must actively collaborate

Our planners ought to be sitting down with your planners and with military planners to see how the entire society and the entire economy are going to be affected by these changes.

h School Graduates: United States, 1977–78 to 1991–92



HIGHER EDUCATION AND LIFELONG LEARNING

Panelists Theodore Bickart, Michael Danchak, and Leon Botstein considered the implications for higher education of the increasing need for mid-career training and education of scientists and engineers from the perspective of university leaders. At issue are the difficulties technical professionals face in keeping current over the course of a career, the importance of a good baccalaureate education, the role of technology in enhancing education, and the most appropriate curricula for scientists and engineers.

Effective Education, Technology, and Teaching

Theodore Bickart
Dean of Engineering, Syracuse University

The question of cost effectiveness of educational opportunities is central to any discussion of corporate education for high tech industry professionals. The cost per class hour in a university classroom falls somewhere between the cost of premium, on-site corporate education and that of new high-tech delivery systems such as those utilized by the National Technological University.* Higher education needs to decide which approaches to education and training are appropriate, to look at the cost of the various appro[a]ches, which ones the universities pro[v]ide. I do not believe that u[n]iversity cost ineffective. In fact, w[e] fective, provided we can [k]eep of technology as if it is drivi[n]g

Educators must creative[ly] nological means and teach[ing] have to use more technolog[y] ity of what we are teaching the cost. Hurray! Faculty sponded conservatively to [t]ech ogy in the classroom and s[o] lad possibilities for delive[ry] including tutored video, inte[r]active instruction, and possibly [e]ven right into the middle of a co[m]pany industry can do a better [j]ob nal. In the long run, this shou[ld] I like to think of this as video and I think we owe that to

Colleges and universities in the education of students undergraduates or graduat[e] ades of their work experience faculty stay relatively curren[t] remain up to date by active[ly] in the corporate world and ple from industry to come

*See description of NTU, page 57.

Bickart: "Educators must creatively use a variety of technological means and teaching arrangements."

Reward systems at universities should not be changed too rapidly in response to industry's needs. High technology industries look to research universities for their premier talent. If we drastically change

the reward system: the top quality research associated with universities could move to industry and we may end up with just a teaching enterprise in our universities. Universities, however, should stop viewing faculty whose primary interest is in teaching as "second class" members of the academy.

Regarding the "half life" of engineering skills, the majority of the curriculum in an engineering education involves basic education that transcends the short half life of the technical skills which comprise only about 30 percent of the curriculum. This concentration on the basics best prepares students to continue to learn throughout their careers.

Continuing education in the sciences is changing with more direct involvement by the faculty. The disciplines are going to have to participate more in the definition of what will go on in continuing education.

Knowledge Maintenance For the Professional

Michael Danchak
Dean of Engineering, Hartford Graduate Center

It is necessary to upgrade and refresh skills over the course of an employee's whole working life. We can't just grant the degree and send the graduate out the door. Whether we can put oak leaf clusters on masters or bachelo
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uilt on rigor, . . . it
e fundamentals."***

commonly held notion that engineers begin to become obsolete by age 35 is ridiculous. Lifelong learning can prevent atrophy.

We have to be in a position to offer industry a choice which, in its terms, might be called a "knowledge maintenance contract."

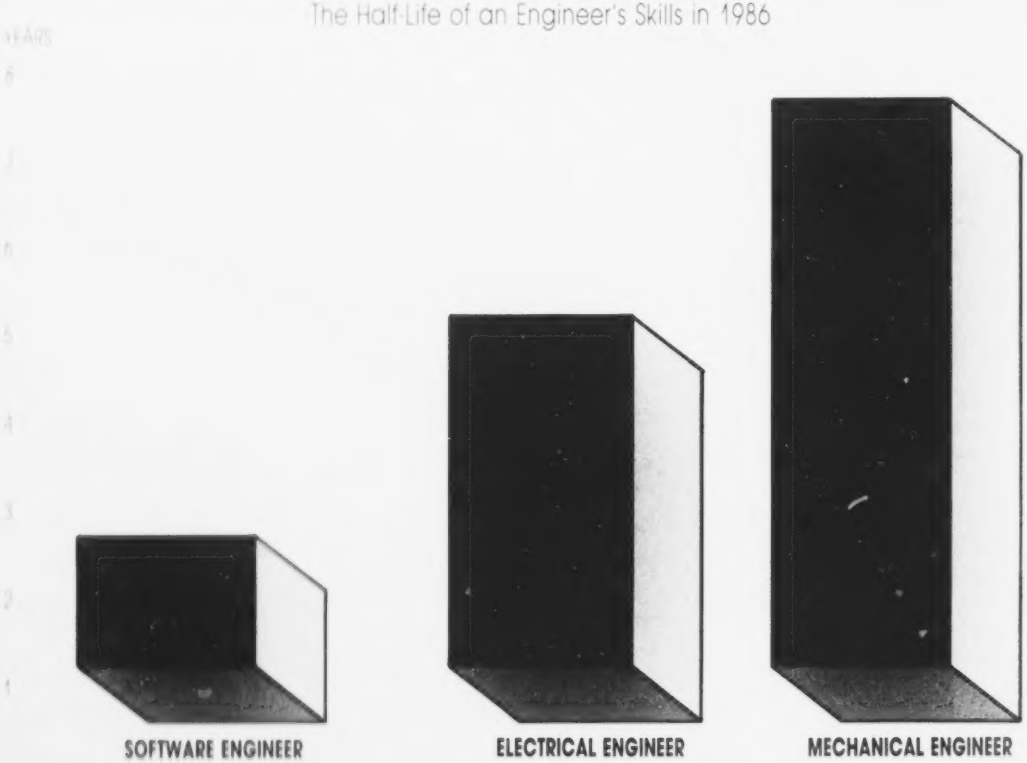
This approach has three major components: 1) remedial education, 2) formal education, and 3) technical updates. Engineers and scientists need to forestall obsolescence through the study of "forgotten" knowledge as well as new technologies.

Very often, we must awaken old skills that have not been exercised recently. Older employees may need to review basic mathematics and scientific principles before attempting to understand the technical details of new technologies. They need to review, from time to time, subjects such as calculus or quantum electronics, knowledge they may not have used in some time.

Also, new graduates need to delve into narrow areas in much greater depth. This "first pass" through the cycle leads to a masters degree. However, people need periodically to return to the classroom, with all its homework and examinations, to keep an open mind regarding change.

Finally, technical updates must be integrated into the lifelong educational process. These updates may be of the survey type as well as in-depth

The Half-Life of an Engineer's Skills in 1986



to allow the engineer to understand and contribute to the technology. This component may be the most amenable to instruction via computer or television. I am advocating a "knowledge maintenance contract" that is built on rigor, insofar as it emphasizes the fundamentals.

Corporations should re-evaluate their paths to career advancement. Too many engineers believe that the way to move up in the company is to obtain an MBA as their first graduate degree and become a manager. When they are not promoted they become disillusioned. At least in the Hartford area, corporations are recognizing this and are saying that "the working degree" in engineering is the master's degree. We will consider funding an MBA after you have a subject master's.

Educators must look closely at what they teach. We are in education, not in training. Fundamentals are important. We need to be responsive to industry but someone has to step back and say, "But should we be teaching about manufacturing, or is there something fundamental under there that may be an application of manufacturing? Is there a more generic principle we have to address?"

Technology must be used thoughtfully in education. The main role of faculty is to motivate students to pursue learning on their own. Use technology, but always keep in mind that just dispensing the

Botstein: "By definition, teaching is inefficient, human, and interactive. Technology can supplement the teaching enterprise, but cannot fundamentally change it."

EARLY RETIREMENT

Like the need for employee retraining, the trend toward early retirement presents opportunities for collaboration between industry and higher education. Some early retirements are the involuntary result of corporate realignments. In 1986 alone, corporations such as A.T. & T., Kodak, Exxon, General Motors, and CBS all used early retirement benefits as a way to reduce their work forces. In September 1986, IBM announced new early retirement benefits. The move was designed to improve the company's competitive strength by reducing costs and to allow IBM to preserve its full employment tradition.

But an increasing number of employees take early retirement voluntarily as a prelude to a second career. Retirements of all kinds reflect complex changes in our economy and society, and the patterns are sometimes contradictory. Dale Hiestand, along with George Anderson, Letitia Chamberlain, and Art Pumo, discussed these trends and the challenges they present to corporations and to educators.

Many professionals make se university programs play an

Early Retirement: Implications For Higher Education

Dale Hiestand
Professor, Columbia University's
Graduate School of Business

Average retirement age has been dropping, yet recently enacted legislation seeks to make it possible for individuals to remain in the workforce longer. While it was once conventional wisdom to consider 65 retirement age, a significant proportion of men withdraw from the labor force as early as age 50. The proportion has been growing for a generation. In 1985, one in seven men aged 50 was no longer in the labor force; one in six men aged 60 was no longer employed; and the average retirement age was 63. By 1990, about 40 percent of the men may have retired by age 60, and the average age of retirement may be less than 62. With each generation, more women are in the labor force, peaking at age 50. But of women aged 60 or over, two of three are not employed.

Conflicting Pressures

This trend has been complicated by contradictory pressures at work in society. The trend in legisla- tion has been to bar d because of age. In 19 tory retirement before autumn of 1986. Cong datory retirement at ar laws, intense economi along with domestic c tions, have forced m workforces through te

Thus, retirees puts heterogeneous group ment are as varied a it may be a liberating it can be a devastati Middle-aged students perience a period of e of self-fulfillment. Stu choices may require t chological counselin

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The Economic Costs of Early Retirement

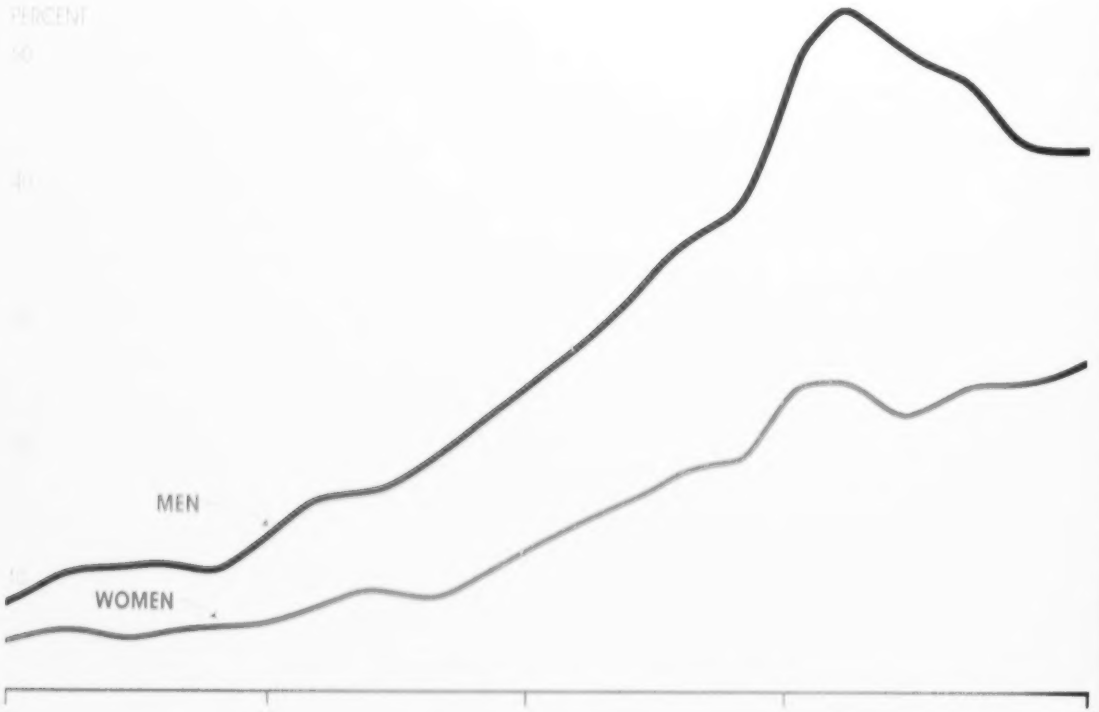
George Anderson
Manager of Corporate Education and
Retiree Relations, ALCOA

The issue is really one of longer life expectancy, rather than early retirement. Along with tremendous opportunities for personal growth, longer life expectancy also involves enormous economic costs. We say our private pensions are well funded. True. But the medical portion is not. The cost to fund the medical portion of pensions long term is more than the current assets of all the major corporations in this country. ALCOA currently spends $100 million annually for the medical portion of retirement and expects to spend between $300 and 400 million a year by the turn of the century. Ongoing health education is an economic necessity.

The ratio of workers to retirees is changing drastically. In 1950, 49 workers supported one retiree. In 1985, the ratio was 1.7 workers for each retiree.

By the year 2000, there will be 55 million Americans over the age of 65. Assuming that 5 to 6 percent of the employees take advantage of pre-retirement courses, three million older students may seek educational opportunities long term, if the right programs are offered.

Percent of Population with Pension Income, 1983



SOURCE

Retirees as Students

Letitia Chamberlain
Director, New York University's
Center for Career and Life Planning

Our center counsels between 2,000 and 3,000 adults of all ages each year. We are just beginning to learn about the stages of adult development. When you talk about a group of 55-year-olds, you are talking about a group that is so diversified that our language has not yet caught up with us and neither has our education.

In American society, personal identity is so closely tied to work roles that retirement and loss of that identity often present a stressful transition. Psychological needs must be addressed. None of the education that we can offer will be useful to people unless anxiety is reduced and stress is handled.

Courses for older students must be tailored to the students' needs. Because they are wiser and more discriminating, they need sensitive teachers and need to be involved with their learning. Staff development is essential to providing their instructors with the requisite skills.

Active encouragement, planning, and anticipating are crucial for a successful transition from worker to retiree. I would like to see many more corporate/university collaborations. There is ample room for collaboration between the private and the university sector.

Second Careers

Art Fumo
Manager of Retirement Programs, IBM

Second careers will become the norm in society. What is new is that early retirement opportunities, the financial feasibility of a longer life, and good health all lead to a second career. What is new is not that you can have a few more good years on the golf course. It's that everyone now foresees a future in our society where two careers, not one, will be standard for many people. We need help to prepare for that.

Corporations are already providing a variety of educational opportunities for employees planning to retire. IBM offers retirement-related education assistance from five years before to three years after retirement. In 1985, some 9,500 IBM employees and their spouses attended the corporation's Retirement Education Assistance Program. Recently, IBM offered opportunities for retirees to return to work on a temporary or part-time basis in order to ease the separation from coworkers and the workplace.

According to the United States General Accounting Office, white males and high school graduates have the highest rate of early pension receipt. Military pensions account for more than 50 percent of recipients under age 55. Approximately 50 percent of men and 38 percent of women receiving private pensions in this age group have disability-related benefits.

Pension receipt reaches a high of 51 percent for men at age 66. The zenith for women is 24 percent at age 70. The difference in pension receipt rates for men and women can be attributed to the fact that fewer women have extended involvement in the workforce. Many women restart their careers later in life, accounting for the later peak age for pension receipt.

Models of Corpo
Collabor

Pennsylvania Technical Assistance Program

The Pennsylvania Technical Assistance Program (PENNTAP) was started in 1965 by the Pennsylvania State University Office of Continuing Education and the state Department of Commerce. The program was designed to assist in the transfer of scientific and engineering information to the business community.

In 1972, PENNTAP expanded to assist with problem-solving in the public sector including local, state, and federal governments, schools and colleges, non-profit organizations, and health care groups. Today, Penn State operates 24 offices throughout the state.

Users pay no fees; the program is funded through the state's Department of Commerce and Penn State, which also provides administrative services. Other state and federal agencies co-sponsor the program on a project-by-project basis.

Inquiries are referred to one of eight technical specialists, chosen on the basis of their professional experience and ability to communicate. Specialists hold academic rank in, or are members of, Penn State. They work full time assisting in the transfer and application of technical information for PENNTAP. An advisory council recommends policies and priorities, and evaluates PENNTAP's efforts.

PENNTAP disseminates information through two avenues, a response method and an active approach method. When a pri
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Colorado State University/Hewlett Packard Software Retraining Program

Colorado State University (CSU) and the Hewlett Packard Company (HP) have cooperated to develop a retraining program for HP professional engineers. The HP Greeley Division broached the partnership idea with CSU in 1986 because it wanted to retrain mechanical engineers for careers as functional software engineers.

CSU's Computer Science Department, together with the CSU Division of Continuing Education, developed a highly intensive, 12-week computer science program on the CSU campus. Three four-credit courses address computer architecture, programming systems concepts, and operating systems. After successfully completing the courses, participating employees continue their computer science education by enrolling in the State University and Resources of Graduate Education (SURGE) program, an on-site videotaped program which leads to a masters degree in computer sciences.

CSU also provides several on-site undergraduate programs for Hewlett Packard employees at three separate locations. Whereas the engineer retraining program is held on the CSU campus to take advantage of the University's facilities and faculty, the undergraduate programs are all held on-site to provide maximum convenience to students. HP employees take the courses after work, thereby avoiding the problems of commuting to

class. The courses are taught by regular CSU faculty who travel to the HP sites.

Both the Hewlett Packard Corporation as a whole, and individual employees have benefited from the relationship with CSU. The software retraining program is more cost effective than any the corporation could have mounted on its own. Moreover, the retraining program has enabled HP to retain high quality employees and shift them to more promising positions within the corporation as the opportunities in their original fields diminish. The undergraduate program has updated the skills and knowledge of many HP employees in a setting that facilitates both academic and occupational endeavors.

Affiliation with Hewlett Packard has provided important benefits to CSU. The university has received equipment and donations from the company, and traditional CSU students have had access to HP experts, who have served as affiliate faculty members on campus. CSU faculty have increased their business associations and research opportunities in the corporate world through greater contact with Hewlett Packard personnel.

National Technological University

The National Technological University (NTU)—a non profit corporation—was established in 1984 to meet the educational needs of engineers and technical professionals [illegible] advanced education [illegible]

During its first year [illegible] 1986), NTU delivered [illegible]

Participating universities [illegible] which facilitate the [illegible] video information and

through satellite delivery of
to the workplace
of satellite curricula (1985-
more than 300 courses and

4,000 hours of credit instruction from its Fort Collins, Colorado center. While not a university, NTU does award its own masters degrees in computer engineering, computer science, electrical engineering,

es in the National Technological University (NTU) system have satellite uplinks
ansmission of engineering courses as well as faculty conferences, student ad
a special programming.

engineering management, and manufacturing systems engineering. Many non-degree students, however, take courses to upgrade their technical skills for specific job needs.

NTU delivers courses from 22 participating universities, all of which are members of the Association for Media-Based Continuing Education for Engineers (AMCEE). Experienced faculty from such institutions as Boston University, Michigan Technical University, and the University of South Carolina serve as instructors. Instructors are paid on a per-student formula by NTU, and universities receive tuition per semester hour for the courses they offer.

Participants must be sponsored by their employers, with the sponsoring corporation providing the on-site classroom. NTU acts as a link between the students and the universities, coordinating course schedules, tuition and fees, and student support services. The logistics of homework and grading generally are handled by the continuing education division of the university delivering the course.

Most courses are recorded at the universities and then transmitted to the students at their work sites. Live teleconferences, computer conferencing, and electronic mail facilitate instructor-student communication.

Corporations find that satellite courses are convenient and flexible, and that on-site delivery greatly reduces the costs of retraining employees for constantly changing technical po
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and logistical complexity.

The UCSD Executive Prog for Scientists and Enginee

The University of Californ
Executive Program for Scien
(EPSE) addresses the special n
tists and engineers wishing to
gerial capabilities.

Initiated in 1983, UCSD
worked closely with industry l
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cation. The program builds o
University and its on-campus re
porating advisors to focus the
cific needs of businesses. Th
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EPSE is a nine-month, non
classes held once a week for

sitions. Although the problem for this com- versities have reaped ciation with NTU. The rogram's audience, siness increases the university's courses corded, universities ivery at minimal cost

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a-San Diego (UCSD) tists and Engineers eeds of senior scien- expand their mana-

University Extension eaders from the San ogram that takes ad- th industry and edu- the strengths of the esources, while incor- program on the spe- s has assured maxi- rsework to technical

credit program, with seven hours. Partici-

pants receive instruction in managing profession- als in high technology companies, developing tools for organizing, planning, and control, and planning and implementing strategy. Courses are taught by UCSD and San Diego State University faculty, as well as by members of local industries selected by University Extension.

The program is designed for the professional engineer or scientist who holds, or is about to assume, a managerial position. Participants are company-nominated professionals with at least five years experience who hold baccalaureate or masters degrees in an engineering or scientific field. Some participants hold doctorates.

Positive media coverage has helped to pro- mote UCSD University Extension in the field of ex- ecutive and professional education. UCSD now offers a Professional Certificate in Engineering Man- agement and is developing an executive program for engineering and research and development vice presidents. The expanded partnership be- tween UCSD and area firms has given the Univer- sity the experience necessary to cater to specific business needs. Since the summer of 1985, Univer- sity Extension has offered eight yearly seminars through the CONNECT program. CONNECT uses the resources of the University to link high-tech en- trepreneurs to the technical, managerial, and fi- nancial resources they need by taking advantage of UCSD's extensive business associations.

University of Illinois-Motorola Masters Programs

In the course of the last decade, the University of Illinois at Chicago (UI) has developed masters degree programs in mechanical engineering, electrical engineering, and computer science for Motorola Corporation professionals wishing to acquire advanced technical skills.

The Division of Continuing Education at the University of Illinois is responsible for initiating the cooperative arrangement. The programs are now overseen by full-time UI administrators. A committee of University faculty and industry representatives determines the course schedules and all classes are held at Motorola's Schaumburg, Illinois site, 40 miles from the UI campus.

Each year, approximately 100 Motorola professionals enroll in the program. Each class meets twice weekly for two hours during regular work hours to accommodate participants. Class size varies from as few as seven students to as many as 35. A student can earn a masters degree after successfully completing 12 courses, including a thesis or research project. On UI's quarterly, year-round system, a degree can be obtained in about three years, although many participants take longer to complete their course of study.

UI faculty participate in the Motorola programs on a voluntary basis. The courses are counted as part of the regular teaching load of the faculty, so no additional compensation is received other than transportation costs. Instructors are available to meet with students before and after class to answer questions or alleviate any logistical problems that may develop.

The Motorola program yields important benefits to the university as a whole. As a result of the program's, several faculty members have become technical consultants for Motorola. Such faculty are able to stay abreast of state-of-the-art technology in the workplace and pass along the experience to their traditional students on campus.

The visibility of the University of Illinois at Chicago both within Motorola and elsewhere in the high-tech Schaumburg area has been enhanced. As a consequence, the University has received new industry scholarships, equipment donations, and co-op programs.

Motorola also benefits from the relationship with UI. Professional technical skills are updated at a fraction of the cost of an in-house program. The corporation taps into UI resources more easily than before through personal contacts with faculty and administrators. In so far as technical skills tend to become obsolete very rapidly, the masters degree programs have helped Motorola recruit new professionals who are more cognizant of the need to update their education.

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